

National Estuarine Research Reserve System

**Kachemak Bay
Research Reserve**

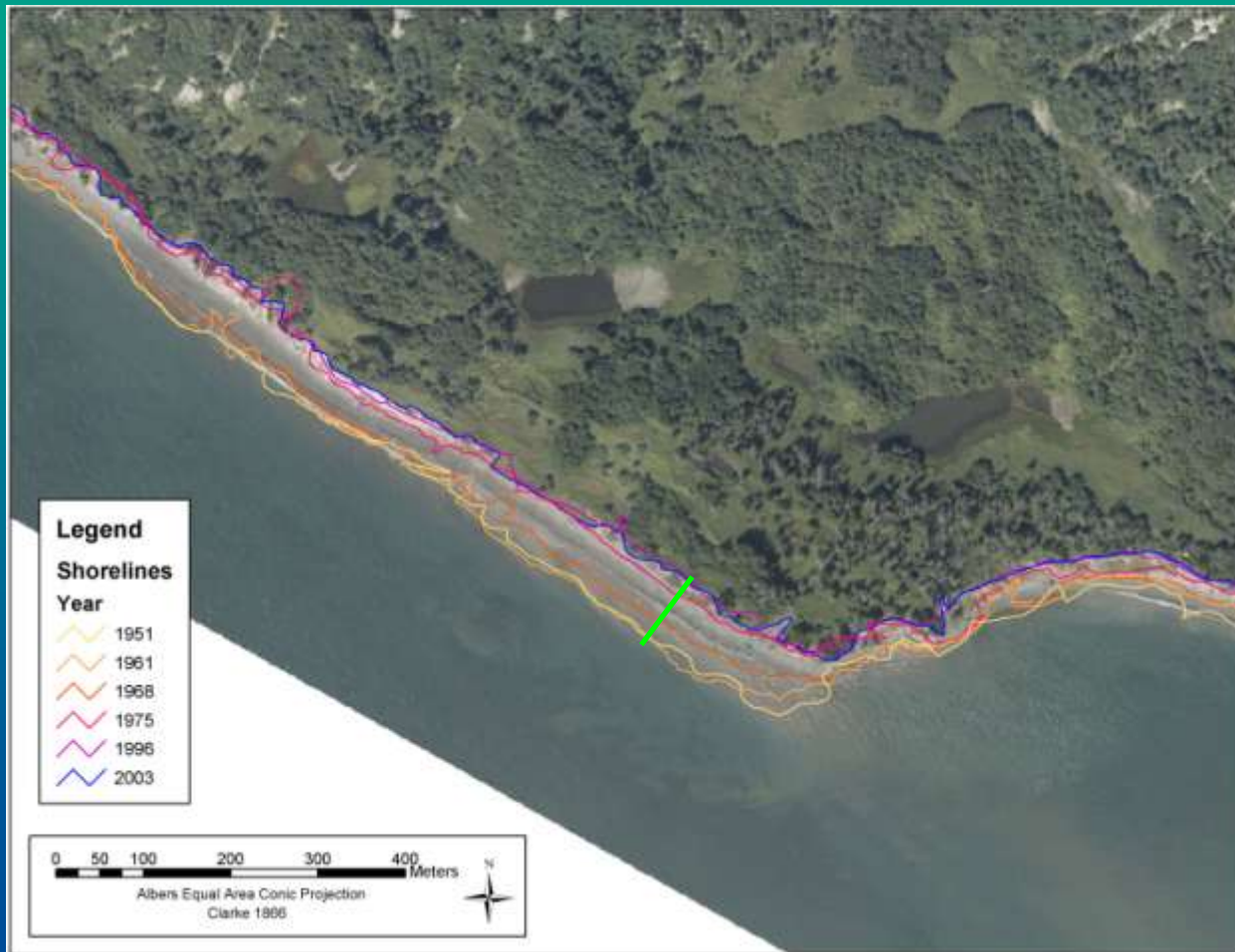
60 years of change in Kachemak Bay

Changing shorelines, salt marshes and glaciers



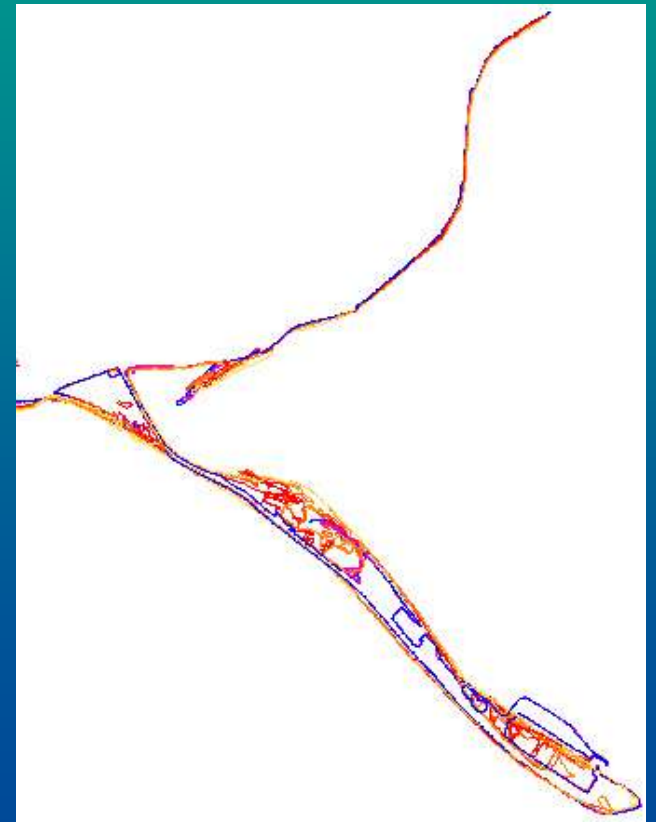
Steve Baird, Kachemak Bay Research Reserve

Shoreline Change

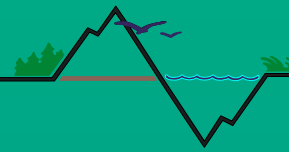


Erosion Rates

- Overall average – 0.7 m/yr (2.3 ft/yr)
- West of Spit – 0.8 m/yr (2.6 ft/yr)
- East of Spit – 0.6 m/yr (2.0 ft/yr)
- 1951-1961 – 1.04 m/yr (3.4 ft/yr)
- 1961-1968 – 0.78 m/yr (2.6 ft/yr)
- 1968-1975 – 1.49 m/yr (4.9 ft/yr)
- 1975-1996 – 0.46 m/yr (1.5 ft/yr)
- 1996-2003 – 0.57 m/yr (1.9 ft/yr)

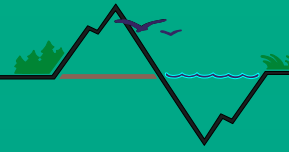


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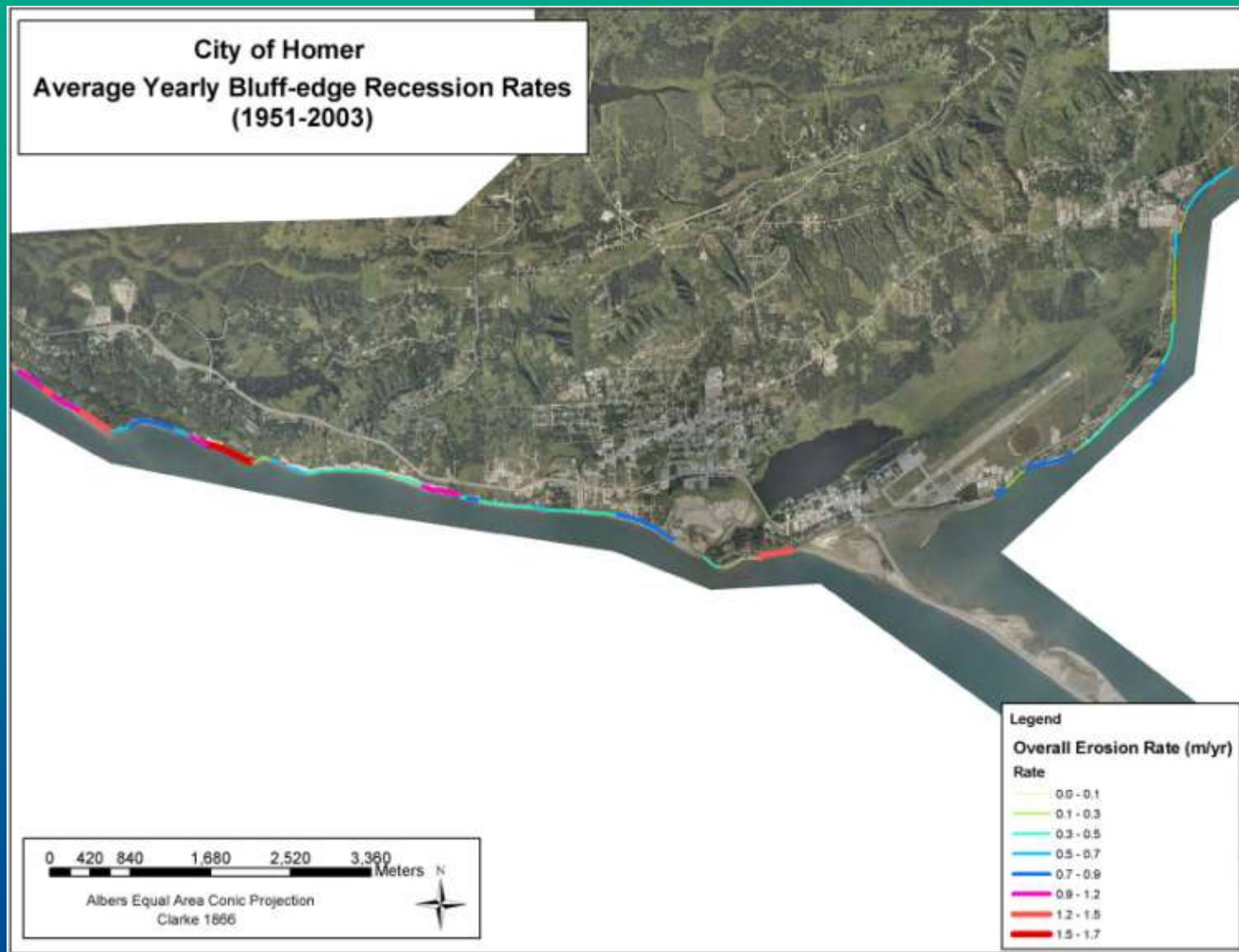
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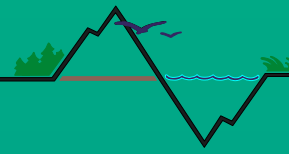




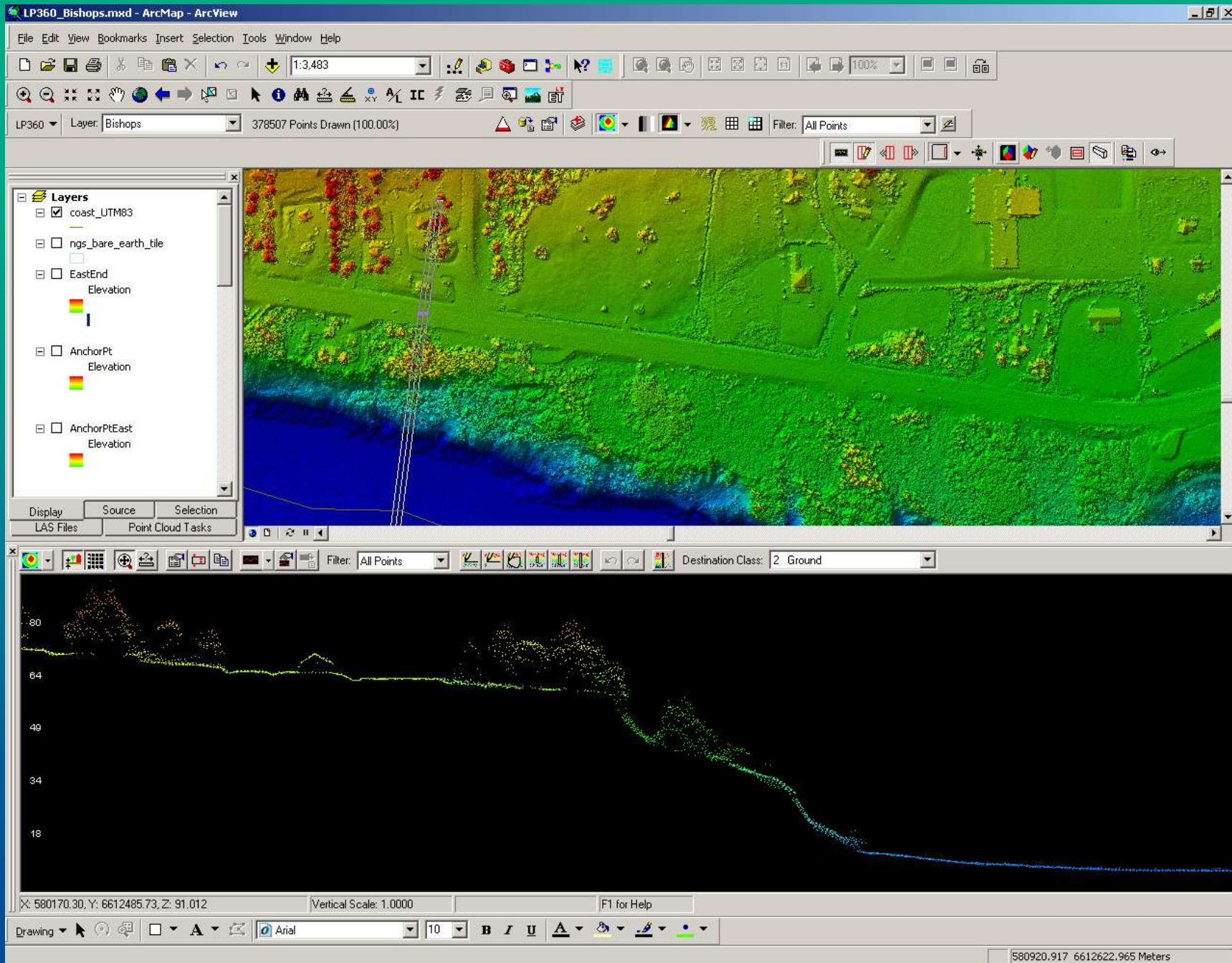
Parcels

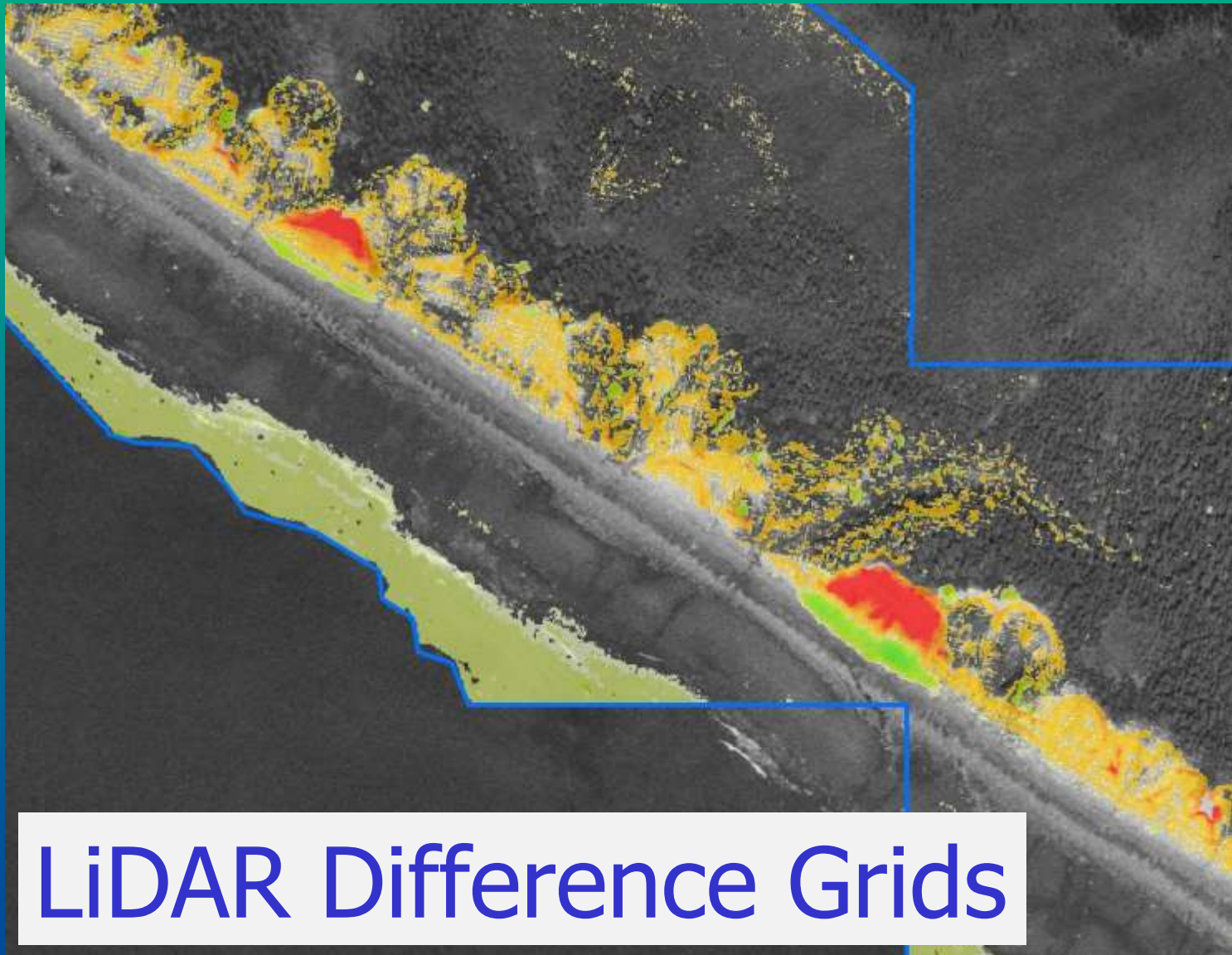
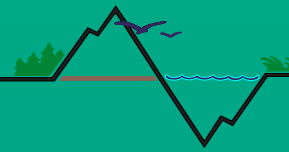






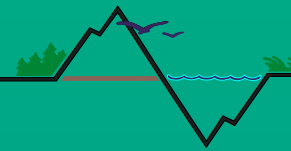
2008





LiDAR Difference Grids



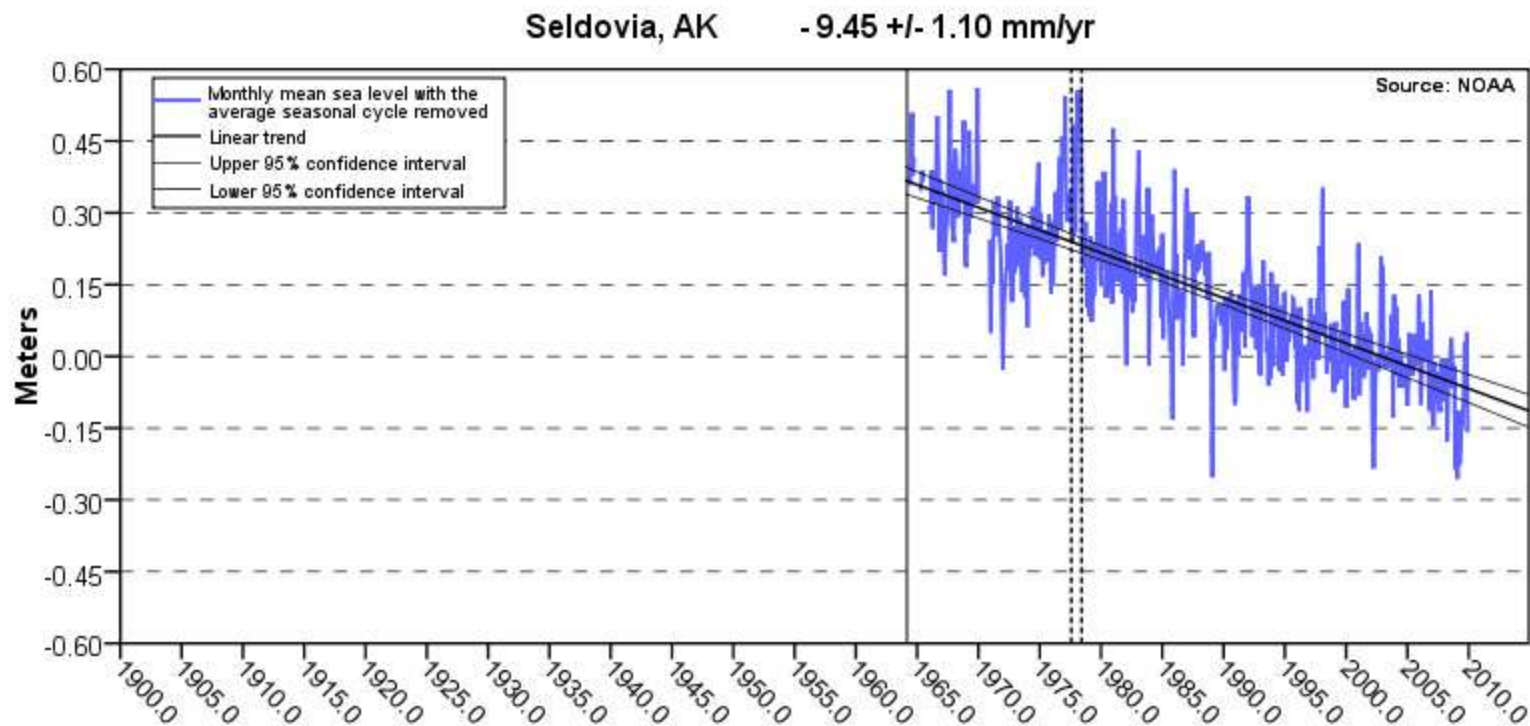


Coastal Erosion and Climate Change



- Erosion rates will be affected by frequency of waves impacting bluff
- Frequency, intensity, and direction of storms
- Relative sea-level

Relative Sea-Level



Relative Sea-Level

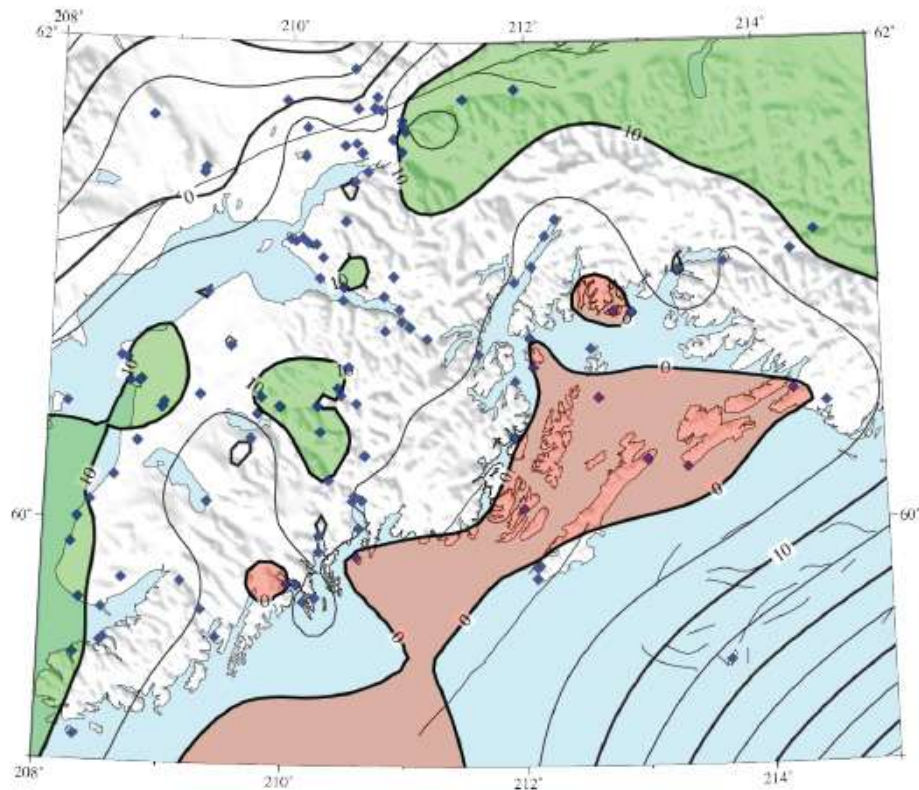


Plate 1. Contoured vertical velocities (1992–2007) from Prince William Sound, the Kenai Peninsula, and Upper Cook Inlet, in mm/yr. Red shaded regions are regions of subsidence, whereas green shaded regions have uplift rates in excess of 10 mm/yr.

From Freymueller et al., 2008

Coastal Uplift

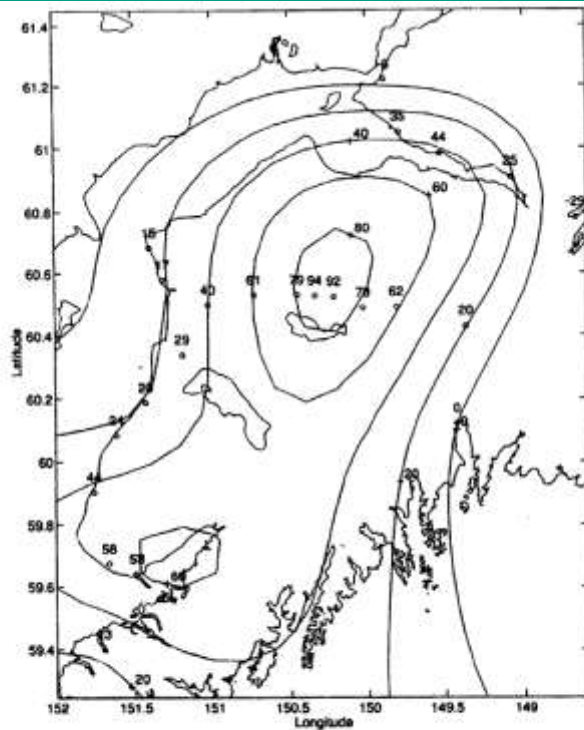


Figure 4. Contours of 1995–1964 uplift (centimeters) based on the data presented in this paper, tide gauge observations at Seward, Seldovia, Anchorage, and Kodiak Island [Savage and Plafker, 1991], and four representative uplifts from a leveling profile along the Turnagain Arm [Brown *et al.*, 1977] multiplied by factor of 1.5 as discussed in the text. The uplift magnitude is shown for each data point. Uplift contours of 0, 20, 40, 60, and 80 cm are indicated. The closely located points R85 and HOMAIR (see Table 1 and Figure 2) are treated as a single point.

From Cohen and Freymueller, 1997

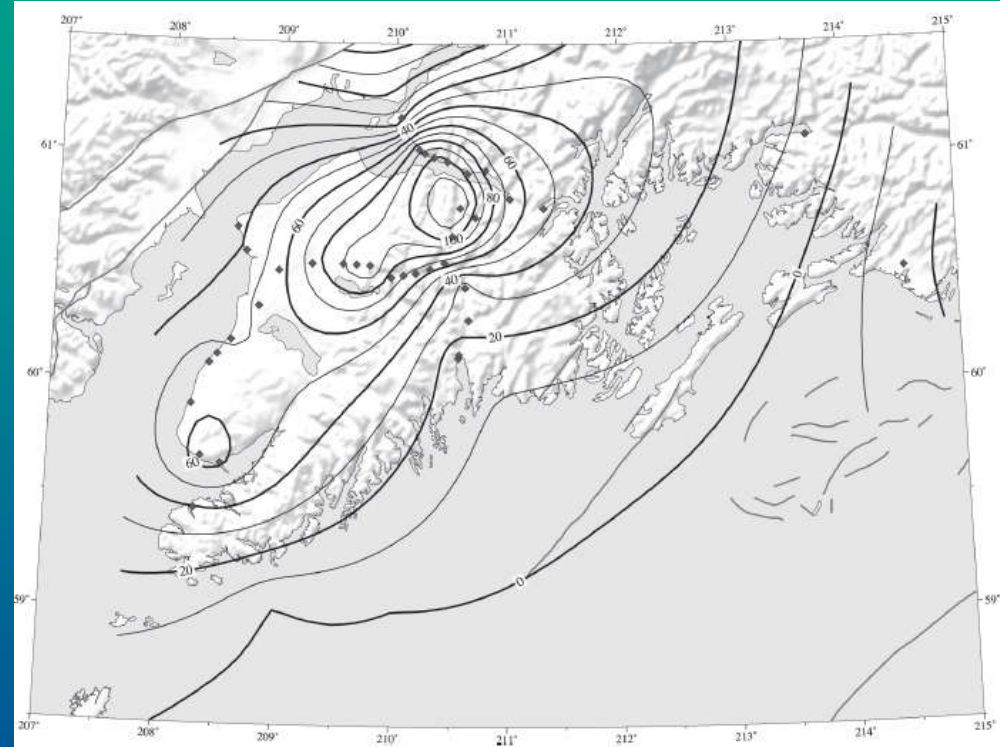
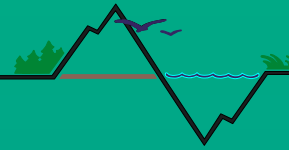


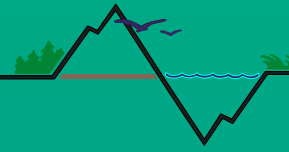
Figure 14. Contours of cumulative postseismic uplift (shown with black lines), Kenai Peninsula, in cm. Uplift data are based on leveling measurements from 1964 to 1965, compared to GPS heights from 1995 to 2000, with correction for the geoid-ellipsoid offset. Lines denote Quaternary and Holocene faults from Plafker *et al.* [1994].

From Freymueller *et al.*, 2008



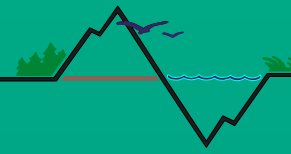
Changes in Salt Marshes





Shifting Salt Marshes





Shifting Salt Marshes

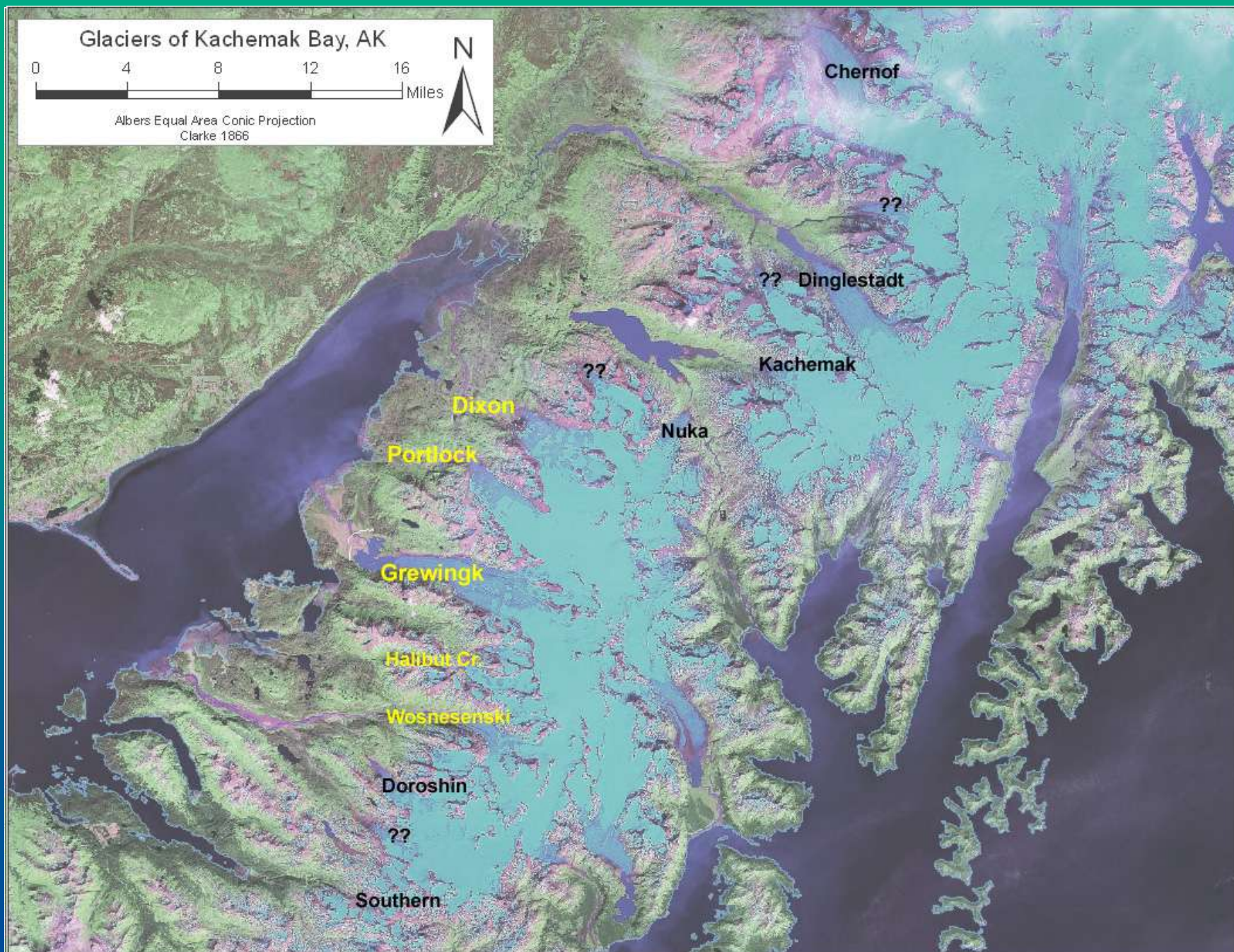


- Sensitive to changes in elevation / sea-level
- Affected by sedimentation rates

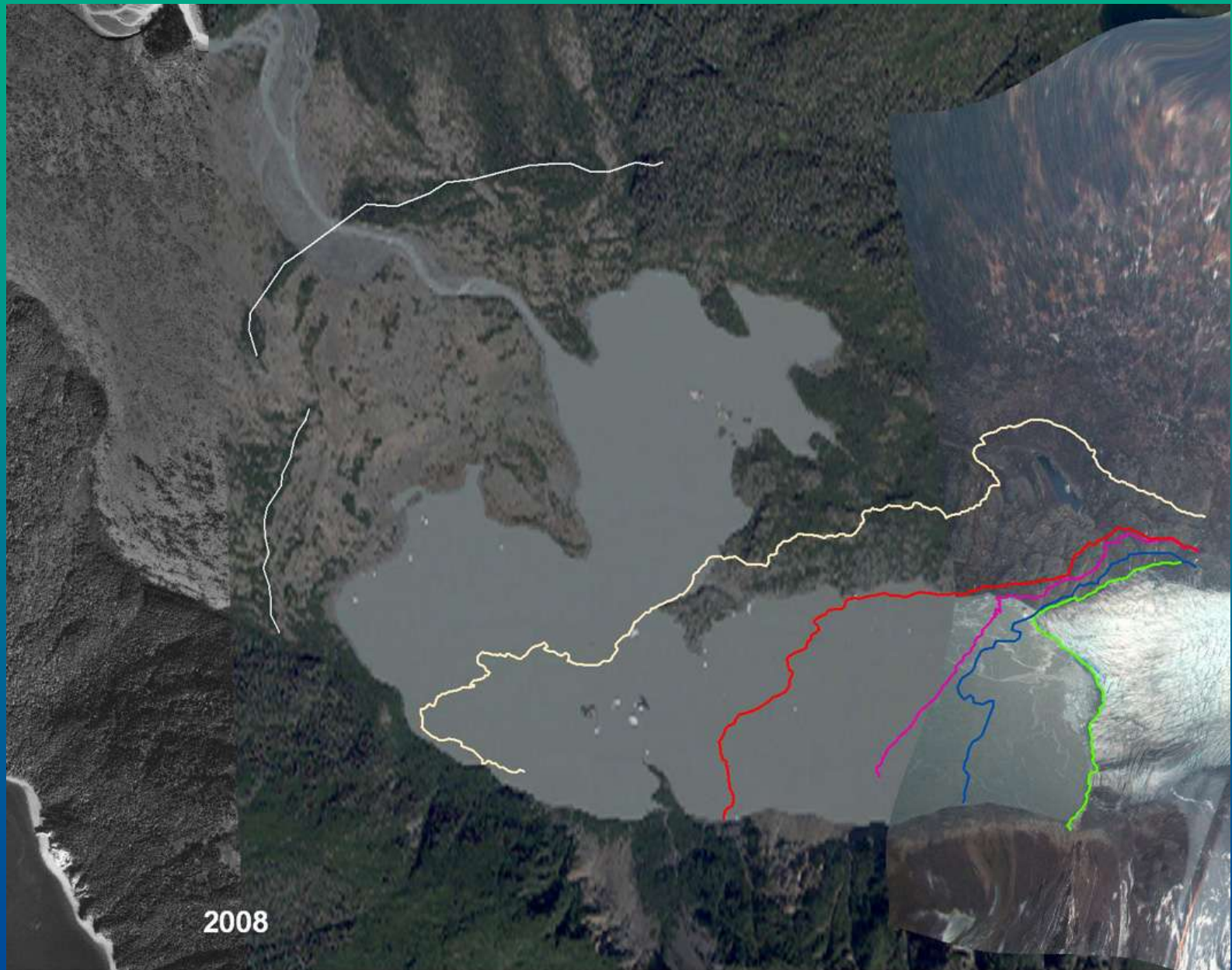
Glaciers of Kachemak Bay, AK



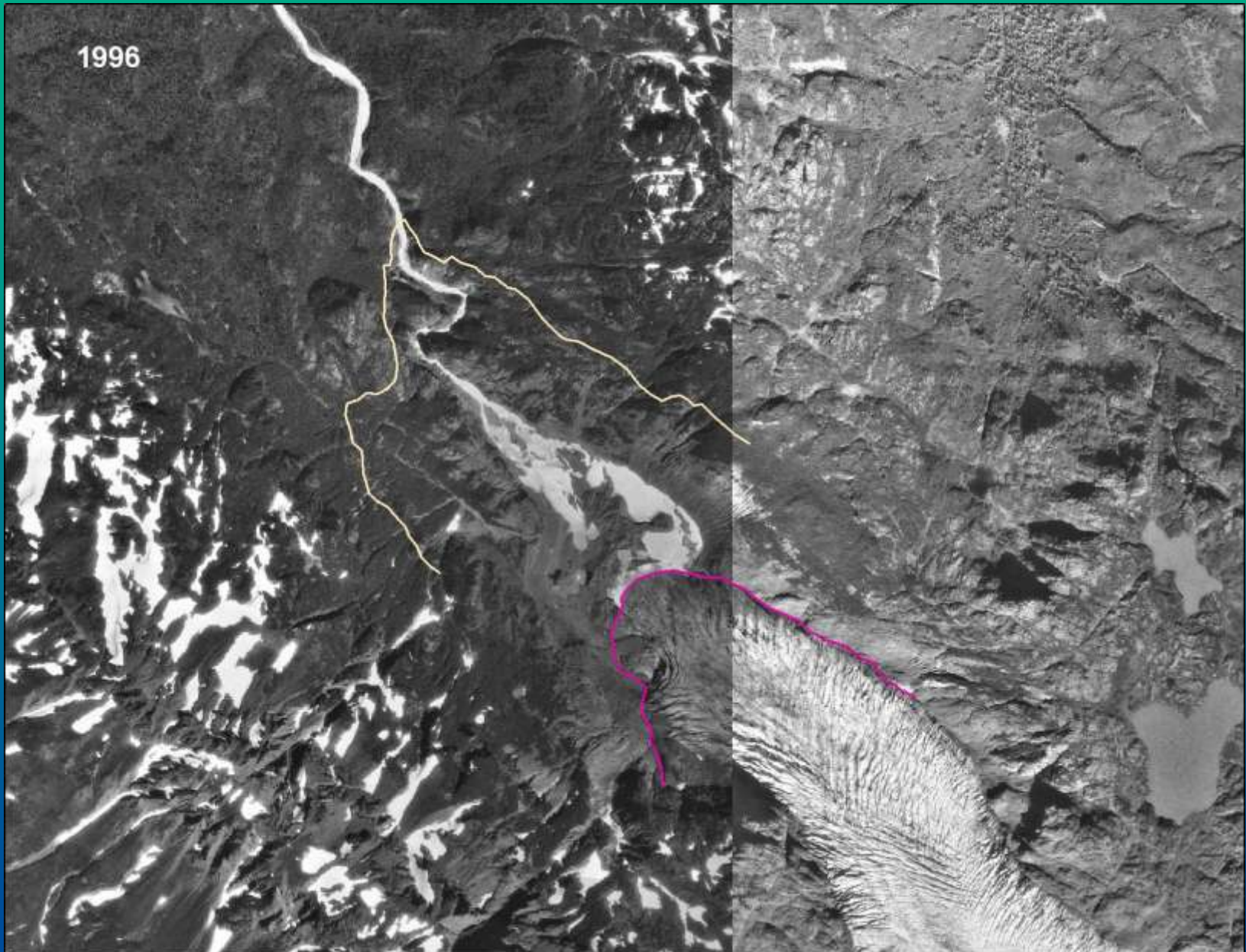
Albers Equal Area Conic Projection
Clarke 1866



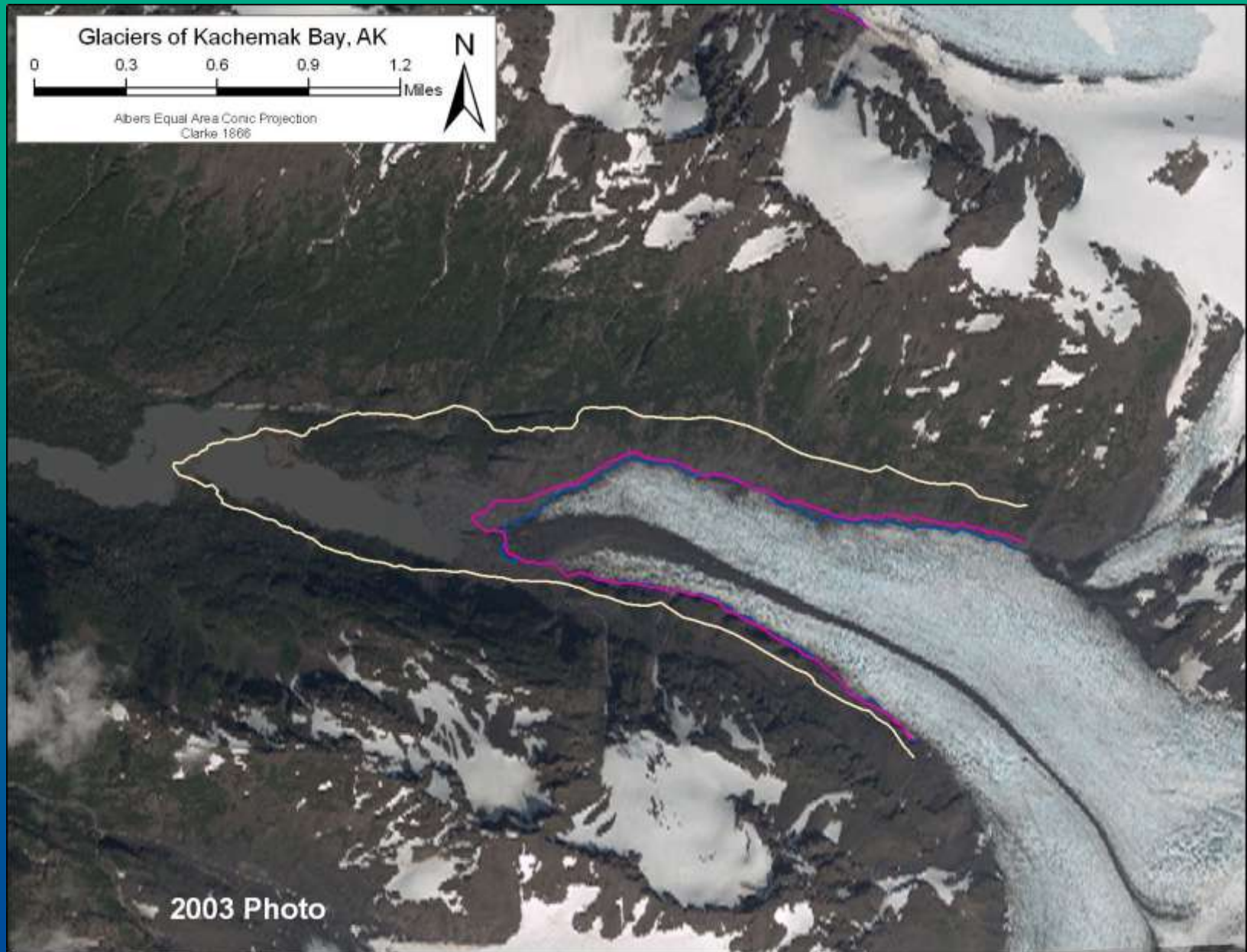
Grewingk Glacier

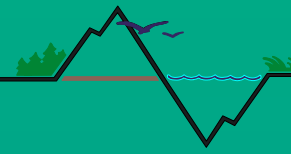


Doroshin Glacier



Glacier





Rates of retreat

| Glacier | Rate (ft/yr) | Miles/56 yrs |
|----------------|--------------|--------------|
| Grewingk | 92 | 0.97 |
| Portlock | 100 | 1.06 |
| Dixon | 105 | 1.11 |
| Halibut Creek | 41 | 0.43 |
| Woznesenski | 115 | 1.22 |
| Doroshin | 100 | 1.06 |
| Doroshin South | 107 | 1.14 |
| Goat | 56 | 0.59 |
| Dinglestadt | 220 | 2.34 |

Glacial Thinning

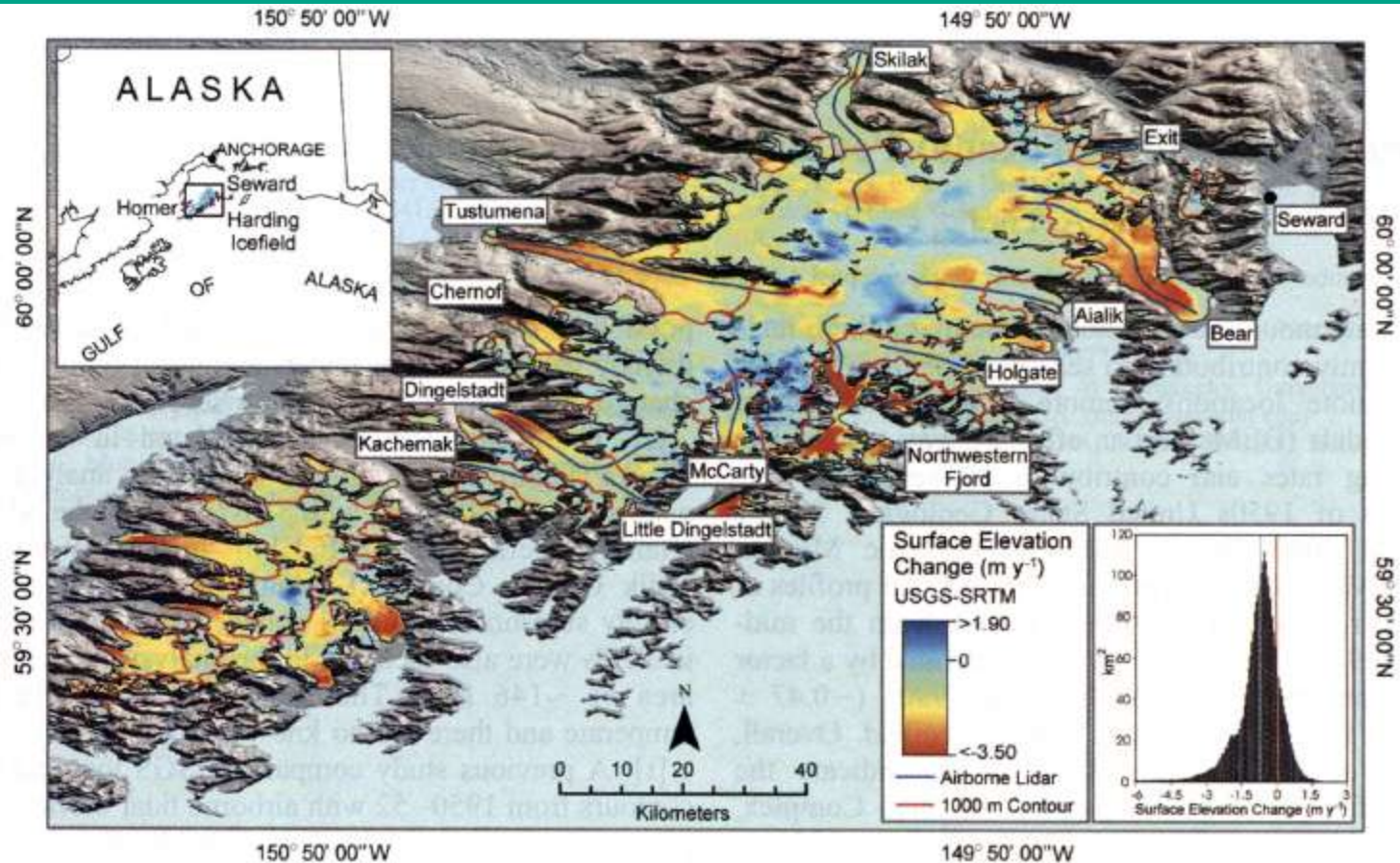
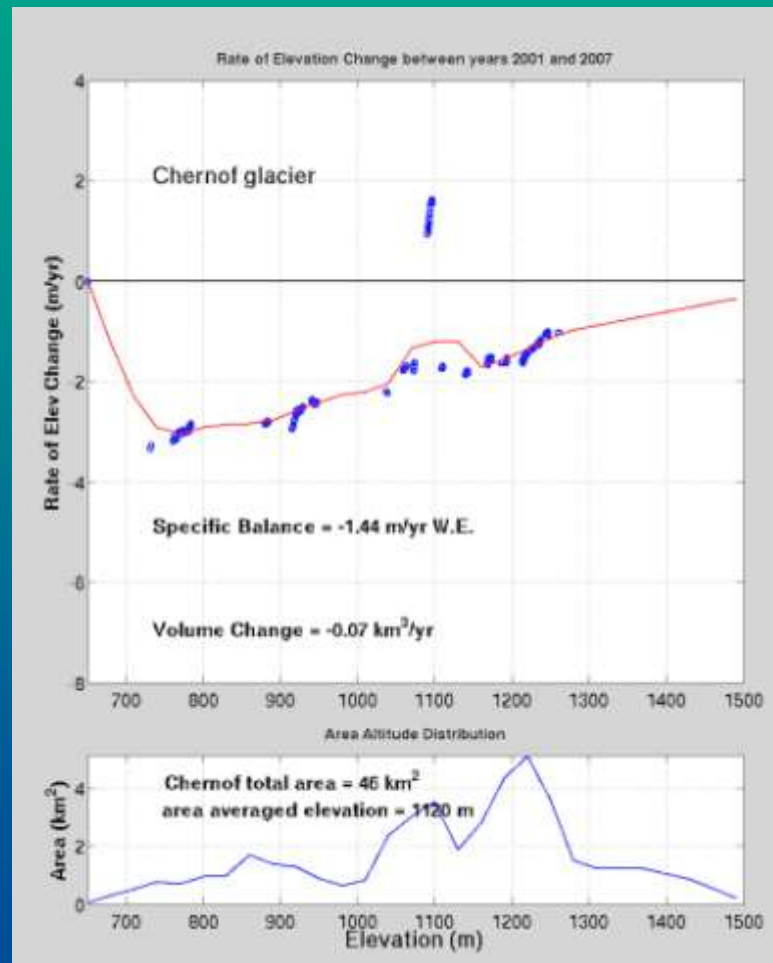
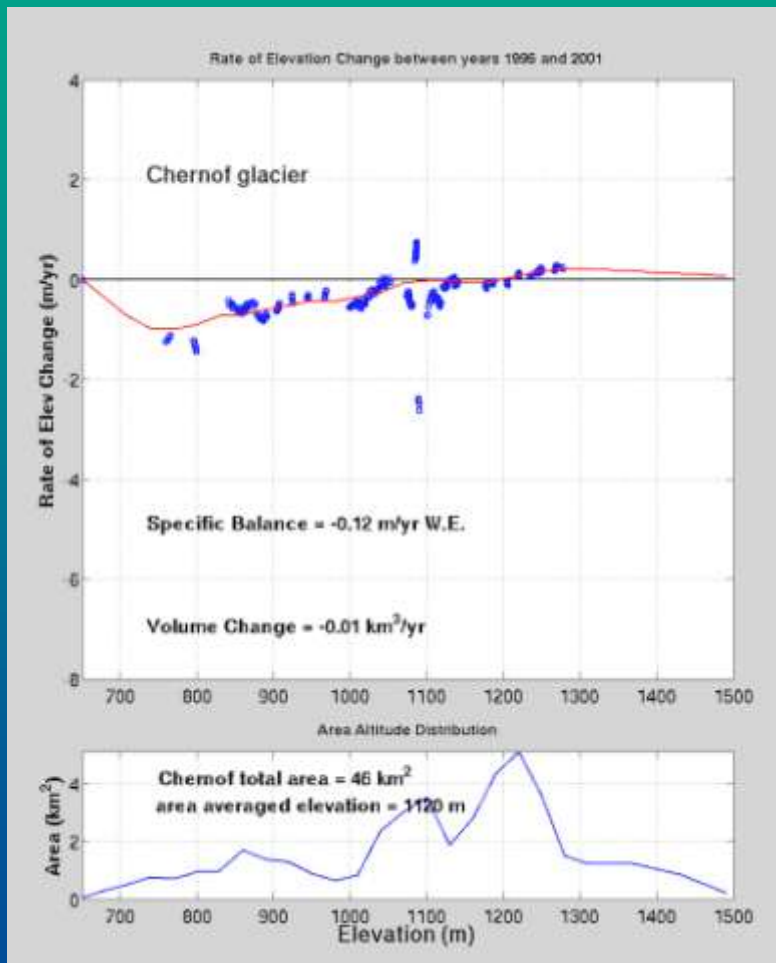
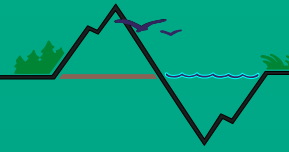


Figure 1. Surface elevation change rates for the Harding Icefield between 1950 and 1999. The histogram shows the distribution of surface elevation changes. Blue line of the histogram is mean surface elevation change (-0.61 m y^{-1}); red line separates thickening (+) and thinning (-) rates.

Glacial Thinning





Summary

- Erosion along Homer shoreline an ongoing concern
- Salt marshes are sensitive to changes in elevation & sedimentation
- Glaciers are receding and thinning, at an accelerating rate
- To predict climate-change impacts, we need to understand:
 - Balance between coastal uplift rates and sea-level rise
 - Whether uplift rates are uniform; relation to underlying geology
 - Changes in frequency, intensity, and direction of storm events
 - Changes in glacial melt and sedimentation rates
 - For salt marsh habitats, the importance of these habitats to a wide range of species